DOCUMENT RESUME

ED 083 551 CS 000 787

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TITLE Retention and Item Comprehension in Prose as a Function of Qestion Placement and Pacing.
PUB DATE Feb 73
NOTE 5p.; Paper presented at the Annual Meeting of the American Educational Research Assn. (New Orleans, February 26-March 1, 1973)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Cognitive Processes; Elementary Grades; *Learning; Memory; Paragraphs; *Questioning Techniques; Reading; Reading Comprehension; *Reading Research; Reading Skills; *Recall (Psychological); *Retention; Sentence Structure

ABSTRACT

The purposes of this study were to replicate the effects of question placement, either before or after, on the acquisition of critical and incidental material with grade school subjects and to determine the effects of paragraph length on learning with children. Two variables, question placement (BA) and pacing (PL), were combined in a 2 x 4 factorial design. Within each factorial cell, type of item (CI), form of item (VP), and time of test (ID) were treated as repeated measures. The final design was a 2 BA x 4 PL x 2 CI x 2 VP x 2 ID with repeated measures on the CI, VP, and ID variables. In addition to the eight experimental groups, two control groups were included. The subjects were 126 students from two fifth-sixth and one sixth grade classroom. A 1,320 word passage constituted the experimental text. The passage was divided into 20 paragraphs, each 66 words in length. For each paragraph, two unrelated questions were constructed. Then a lexical paraphrase was generated for each of the original questions so there was a total of four questions per paragraph. The results indicated that a 2 BA x 4 PL x 2 CI x 2 ID analysis of variance yielded significant results for the BA, CI, and ID main effects and the PL x ID interaction. This study suggested that adjunct questions have different effects as age decreases. (WR)

RETENTION AND ITEM COMPREHENSION IN PROSE AS A FUNCTION OF QUESTION PLACEMENT AND PACING[1]

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Research suggests that it is possible to control the material learned from a passage by directing inspection with questions inserted in the text.

In several studies by Frase (1967, 1968a, 1968b) the results indicate that post-questions facilitate general test performance more than pre-questions. Questions placed before passages tend to limit inspection to critical material, i.e. the material needed to answer the question. However, questions which appear after passages decrease question specific discriminations and promote learning of incidental material also. Although these results have occurred consistently with adult populations, we were unable to find any data gathered on grade school children. Younger learners may react differently to inspection control devices because of shortened attention span or a lack of strongly formed reading behaviors. Thus, one purpose of this study was to replicate the effects of question placement, either before or after, on the acquisition of critical and incidental material with grade school subjects.

Our second question was concerned with the amount of material read before encountering a question. The outcomes from previous research that varied the length of passages associated with adjunct questions in unclear. Shorter passages favor the groups that see questions after the text material while longer segments benefit readers that see questions before reading the material. Frase (1967) has found that reading longer passages facilitates learning when questions do not occur in the reading material. A second object of this research was to determine the effects of paragraph length on learning with children.

Most of the previous adjunct question studies have used immediate posttests containing items identical in form to the inserted questions. According to Anderson (1972), there is evidence that students process and store instructional material in at least two ways. The first strategy is called phonological encoding which is the storage of the printed verbal stimuli. Here a student learns by "rote" a string of words which are meaningless to him, but which he recalls intact during testing. The second type of processing is semantic encoding which requires that the learner remember the meaning rather than the physical features of the text. In this case, the student "comprehends" the material and can identify instructional statements correctly when they are presented in a form substantively different from that initially learned. One way to determine if semantic encoding has taken place is to test recall with lexical paraphrases of the originally learned material. A paraphrase is defined as a parallel statement containing the same semantic content in a different substantive form. For example, "The king appeared mad at the teacher" might be transformed to "The monarch seemed angry with the instructor". These representations differ substantively, but were judged identical in meaning by almost 90% of a high school sample.

It seems possible that effects of question placement result from differences in the type of coding produced. When questions are placed before reading, they may provide the learner with a phonological "target" for his search activities. On the other hand, when questions

follow reading, the learner may attempt to store general information rather than specific verbal units (Sachs, 1967a, 1967b). Another purpose of the present study, then, was to determine if question placement effects were due to differences in the type of coding they produce.

The final variable investigated was retention. If recommendations from adjunct question research are to be instructionally useful, it is necessary to assess their effects over time. It may be that placement, pacing, and encoding parameters may change when material is placed in long term storage.

Method. Two variables, question placement (BA) and pacing (PL) were combined in a 2 x 4 factorial design. Within each factorial cell, type of item (CI), form of item (VP), and time of test (ID) were treated as repeated measures. The final design was a 2 BA (before-after) x 4 PL (one, five, ten, or twenty paragraphs) x 2 CI (critical-incidental) x 2 VP (verbatim-paraphrase form) x 2 ID (immediate-delay test) with repeated measures on the CI, VP, and ID variables. In addition to the eight experimental groups, two control groups were included. One control (C 1) read the passage without questions, and the other (C 2) answered the questions without reading the passage.

The Ss were 128 students from two fifth-sixth and one sixth grade classrooms.

A 1,320 word passage entitled The Island of Ako and Its People (Kulhavy & Swenson, 1972) constituted the experimental text. The passage was divided into 20 paragraphs, each exactly 66 words in length. For each paragraph, two unrelated questions were constructed. Then a lexical paraphrase was generated for each of the original questions so there was a total of four questions per paragraph. An example of one set of questions for a paragraph is:

The first animal children receive is a crab.

Before they have other pets, youngsters are given a crab.

All questions, both in the text and on the posttests were completion questions requiring a written response. In the example questions, the test response is underlined.

Both the paragraphs and the pairs of questions were normed for readability and semantic similarity using 127 fifth and sixth grade students from the participating school district. The norming Ss were familiar with all the text vocabulary except the words coined for places, animals, and plants on the Island. The median similarity rating was 4.22 on a five point scale with five equaling the highest similarity.

One of the four possible questions for each paragraph was chosen as the experimental item, i.e. the question inserted in the text material. The verbatim question, its paraphrase and the remaining set of two questions were included on the posttests to measure mode of encoding and incidental learning respectively. The particular items selected as experimental questions were separately randomized for each booklet, with the restriction that all questions were chosen an equal number of times across conditions.

In the pacing conditions, Ss read either one, five, ten, or twenty paragraphs in conjunction with the same number of associated experimental questions. In the before-groups, the appropriate number of questions were presented before the paragraphs, and in the after-groups, the questions were inserted after the paragraphs. Subjects were required to fill in the blank at the end of each question encountered. The booklets used

in the experiment contained only one paragraph or question per page.

The posttests consisted of all 80 constructed items. Form A of the test contained one form of each item and Form B the other. All Ss received both forms of the test with the item order separately randomized for both the immediate and delay measures.

The experiment was conducted in two sessions with groups of 60 and 68 Ss. Ss from all conditions participated in each session.

Each booklet contained a sheet of general instructions directing the learner to read carefully and not to refer back to material previously read. When all Ss signified that they understood the task, they were instructed to begin reading through the booklet. After completing the text, each S raised his hand and a monitor collected his test booklet, recorded his reading time, and gave him the first Form of the posttest. When the learner completed the first Form, it was collected and he received the second posttest.

One week after the experimental session, both Forms of the posttest were again administered to all participants in the same manner.

Results. A 2 BA x 4 PL x 2 CI x 2 ID analysis of variance on this data yielded significant results for the BA ($p < .05$), CI ($p < .01$) and ID ($p < .01$) main effects and the PL x ID interaction ($p < .01$). No other terms in this analysis reached significance. Clearly, the interaction effect is primarily due to the decrease in performance of the single passage question learners across the retention interval. A 2 BA x 4 PL x 2 ID analysis of variance on the verbatim paraphrase variable yielded no statistical significance. A 2 BA x 4 PL analysis of the reading times was also computed. Again, none of the terms in this analysis were significant. Obviously differences in the posttest scores cannot be attributed to differential study time.

Discussion. The superiority of groups receiving questions after reading is consistent with available data. However, contrary to previous research, post questions failed to facilitate learning of incidental items more than critical items. The fact that critical items were learned consistently better, but did not interact with other variables indicates that storage for learners of this age is best served by specific cuing devices. It may be that children disregard noncued material if cues available to them. This finding supports our contention that control of inspection behaviors is a markedly different task with younger learners.

The absence of main effects for the pacing variable are consonant with many earlier studies. However, the pacing x placement relationship which Frase found (1968b, 1968c; Frase, et al., 1970) did not occur. This difference in our data may stem from our Ss inability to store as much information as more experienced learners.

These data do not support our hypothesis that adjunct questions act on the type of coding in which the reader engages. If an item is stored at all, it can then be recalled in either the phonological or semantic form. This is an important point, since there are studies which suggest that semantic development is far from complete in elementary age children Palermo & Molfese, 1972)

The pacing by time-of-test interaction which was significant is of prime interest. Over a retention interval, the one, ten, and twenty paragraph groups show a sharper drop in recall than do the five paragraph groups. Obviously, the five paragraphs presentation facilitates

long term storage. One way of accounting for this data is to concentrate on 330 words as representing an optimal inspection span. However, sheer frequency is a poor measure of information yield. We prefer to treat text span in terms of the number of important concepts present. Available storage approaches maximum efficiency when the number of information units falls near the classical processing limits suggested by Miller (1956). Apparently, younger learners can efficiently hold about five "chunks" of information for processing into long term storage. When this mid-range capacity is greatly reduced or surpassed, retention suffers disproportionately.

This study suggests that adjunct questions have different effects as age decreases. Longitudinal research is needed before these devices can be used with confidence in designing instruction--at least for grade school students.

[1]Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, 1973.

[2]This research was supported in part by Arizona State University, Faculty Research Grant No. 7805-837-15-8 to the second author.

Means and Standard Deviations for Criterion Test Correct Responses for Question Placement, Question Pacing and Test Time

Group		Experimental				Control	
		Before		After		Read Only	Questions Only
		Critical	Incidental	Critical	Incidental		
Immediate	$\bar{X}$	16.28	9.62	17.80	13.09	9.36	7.91
	SD	8.30	6.69	9.05	7.10	4.52	5.38
Delay	$\bar{X}$	14.08	9.21	15.02	11.20	7.07	3.88
	SD	8.09	6.22	8.61	6.89	4.96	3.11
	N	47		51		6	5